METHOD STATEMENT AND JOB SAFETY ANALYSIS FOR CONCRETE REPAIR WORKS

PT CII REVIEW RESULT TO SUBCONTRACTOR			Issue to PTFI: ☐ For Information (Review Not Required) ☐ For Approval (Review Required)		
			PTFI REVIEW RESULT TO PT CII		
A	**Approved without Comments** Allow to start fabrication.	Approved by:	A	**Approved without Comments**	Approved by:
B	**Approved with Comments** Allow to start fabrication, however, re-submit documents till code "A" from Owner and/or Contractor.	Reviewed by:	B	**Approved with Comments**	Reviewed by:
C	**Not Approved** Fabrication is not allowed. Re-submission is required.	Checked by:	C	**Not Approved**	Checked by:
Reason for "(C) Not Approved"		Date:	Reason for "(C) Not Approved"		Date:
PT CHIYODA INTERNATIONAL INDONESIA			**PT FREEPORT INDONESIA**		
CHIYODA'S APPROVAL OF ANY DRAWING SUBMITTED THERETO SHALL NOT RELIEVE THE SUBCONTRACTOR OF ITS OBLIGATIONS OR RESPONSIBILITY FOR THE ACCURACY AND ADEQUACY THEREOF UNDER THE SUBCONTRACT.					

OWNER : PT. FREEPORT INDONESIA

CONTRACTOR : PT. CHIYODA INTERNATIONAL INDONESIA

SUBCONTRACTOR : PT. WIJAYA KARYA (PERSERO) TBK.

MANYAR SMELTER PROJECT

1	Issued For Construction	30-May-2022	Ari aditya	Ferry	Adi A.
0	Issued For Approval	9-May-2022	Ari aditya	Ferry	Adi A.
Rev.	Description	Date	Prepared	Reviewed	Approved

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APPENDIX

1 GENERAL

The purpose of this method is written as a guidance for the execution of Concrete Repair Works in a safely manner,quality assurance and within target schedule for Manyar Smelter Project, Gresik, East Java, Indonesia

2 REFERENCES

MS-DD-3000-QUA-PLN-0103	Inspection and Test Plan for Concrete Work
MS-DD-3000-CIV-SPE-0104	Construction Specification for Concrete Work
ACI 301M-10	Specification for Structural Concrete
ASTM C1107/C1107M	Standard Specification for package dry, Hydraulic Cement Grout (Non-shrink)
ASTM D1475	Fresh wet density
ASTM D2471	Working life Approx.
ACI 309.2R-15	Guide to Identification and Control of Visible Surface Effects of Consolidation on Formed Concrete Surface
ACI 201.1R-08	Guide for Conducting a Visual Inspection of Concrete in Service
Portland Cement Association IS536	Concrete Information

3 GENERAL LAYOUT

The proposed site location on Area C & E shown in figure:

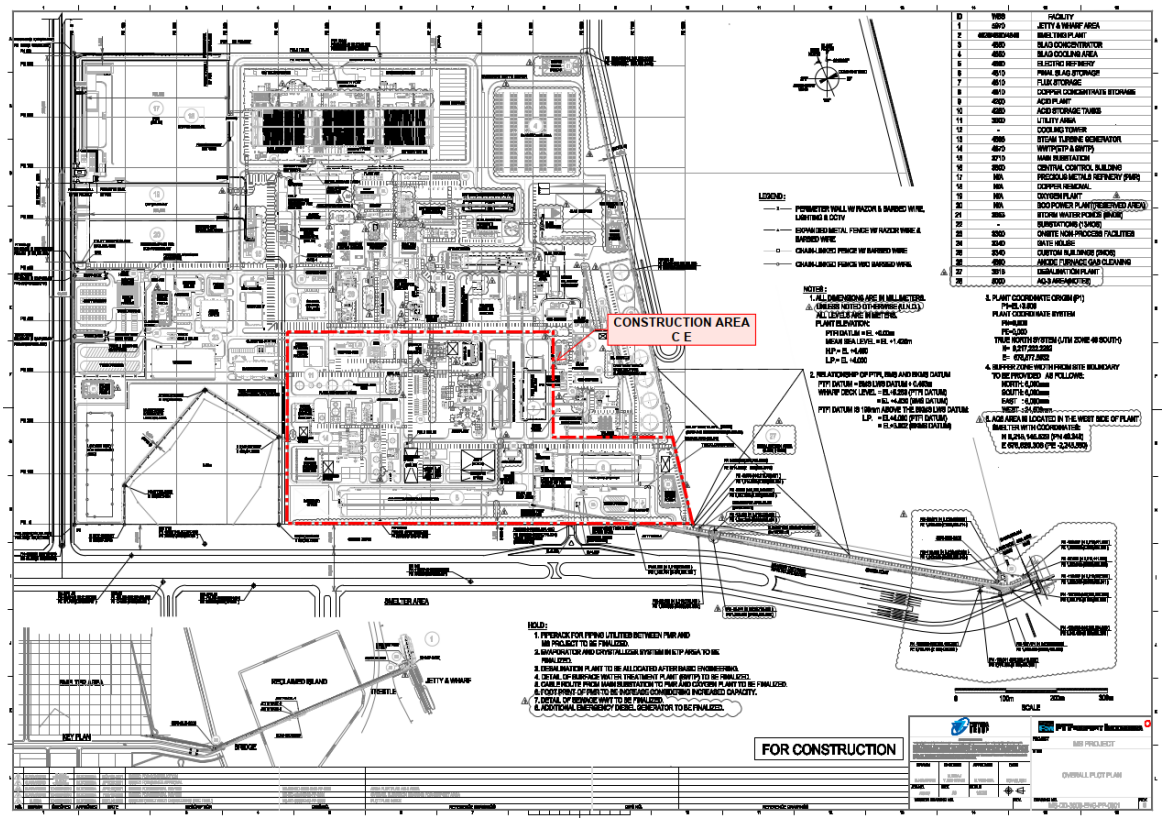

Figure 1: Site Location for Concrete Works

4 ORGANIZATION ROLE AND RESPONSIBILITY

4.1 Project Manager

1. Assuring that all project work in his zone is completed in compliance with Company policies and the requirements of this Quality plan.
2. Ensure that subcontractors are complying to the company's quality policies as well as the requirements of this Quality plan.
3. To ensure that all of the equipment needed to complete the work according to the construction schedule is available and in good working order, and to provide any additional equipment that may be required.

4. To co-ordinate with the Construction Manager, Project Engineer, Safety Engineer, Foreman and Surveyor for a safe and proper execution of the works.
5. **To guide specific attention to all safety measures in co-ordination with the safety officer/engineer.**

4.2 Construction Manager

1. Ensure working area is ready to start working Safely.
2. Set up required equipment and plant through discussion with the Project Manager and Project Engineer/Works Supervisor.
3. Ensure the works are carried out according to the specification, quality and approved shop drawings.
4. Liaise and co-ordinate with the Project Manager for the agreed sequence of works with respect to the construction program.
5. Allocation of required manpower through co-ordination with the Project Manager.
6. Provide the risk assessments for the works in hand.
7. Provide sufficient and safe access for operatives, trucks and pumps.
8. Take precautionary measures with regards to protecting works from hot weather, wind, rain and sun.

4.3 Project Engineer

1. The engineer shall carry out his duties in a manner that shall be coordinated by the project manager on a daily basis, and shall ensure proper distribution of the workforce and equipment at required locations.
2. To be aware of test frequencies related to the formation level.
3. To control disposal of waste excavated material according to the instructions received from the Project Manager.

4. To co-ordinate with the Safety Officer to maintain safe working and proper housekeeping of the site. To comply with the safety measures and ensure that all Safety Officer Teams are aware of the same to prevent accident and loss.
5. To monitor and check all activities and ensure that works shall be carried out according to specifications, quality and approved drawings.
6. To inform the QC Inspector of the areas ready for inspection.

4.4 QA/QC Engineer / Inspector

1. Ensuring that CONTRACTOR's inspection requests are implemented.
2. Compilation of all necessary quality control checklists
3. Assisting CONTRACTOR's during the Inspections.
4. Coordinating with the third party lab regarding tests and results.
5. The control of work performance by means of checking the work before CONTRACTOR's inspection and issuing RFIs & punch lists as necessary.
6. Completion of documentation to verify the work performed.
7. Controlling all inspection activities on-site in line with ITPs.
8. Ensuring that all test equipment including surveying equipment is calibrated and is suitable for use on-site.

4.5 Surveyor

1. To establish benchmarks from agreed reference points, provide required setting out and level markings and follow up with regular checks.
2. Co-ordinate with the Project Engineer / Foreman and ensure the approved shop drawings/construction drawings shall be implemented properly.
3. Maintain survey details and reports, periodically check the progressing works and advise the project manager of any deviation from the drawings.

4.6 HSE Engineer/Officer

1. To ensure that all the persons involved in the works are aware of their responsibilities, and that they have enough understanding of the safety procedures.
2. The safety officer in co-ordination with the Project Manager shall ensure that all the implemented safety measures are effective enough to maintain safe working on the site.
3. To maintain continuous inspections of the site activities, advise and train persons on a daily basis to prevent accidents and personnel injury.
4. To give special concern to house keeping, and ensure that the site is maintained clean and tidy.
5. To ensure all the relevant safety sign boards for different works are in place.

4.7 Foremen/ Works Supervisor

1. Ensure the works are progressed in the sequence as agreed with the Project Manager.
2. Liaise with the Project / Construction Manager for the allocation of the work force, ensuring adequate manpower is available.
3. Liaise with the site manager to ensure all the required plant / materials are available to construct the works.
4. Full time supervision shall be required to ensure the works are carried out in accordance to specifications, quality and approved drawings.

5 CONRETE REPAIR CONSTRUCTION METHOD

As follow CONTRACTOR Specification for Concrete work, All defective concrete resulting from non-conformance to the required materials,construction tolerances, segregation, damage, performance criteria, shrinkage cracks,inconsistent finishes and others shall be in the SUBCONTRACTOR's repair procedure

and at no additional cost to the owner. CONTRACTOR shall be immediately notified by SUBCONTRACTOR if defects are discovered, such as honeycombing or cracking, or condition(s) detrimental to strength, stability, durability and water tightness of the concrete. A repair procedure shall be submitted to CONTRACTOR for approval before starting the repair work. The repair

procedure shall include the following:

(1) Conditions of defect (i.e., extent of honeycombing, width, depth, pattern, growth rate,

time cracking began etc.).

(2) Predicted cause of defect

(3) Effect to the concrete construction

(4) Repair method and materials

(5) Preventive measure against recurrence

All defects shall be removed down to a sound surface. The sound surface shall be inspected by CONTRACTOR prior to repair proceeding.

Note: The following items may not be included as defects, and therefore, repairing may not be required, subject to approval by CONTRACTOR:

- Surface air voids having diameters equal to or smaller than ***19mm*** with maximum depth of ***10mm.***
- Surface cracks having a width equal to or less than 0.3 mm.
- Surface cracks for watertight concrete structure is having a width equal to or less than ***0.1 mm.***

5.1 Type of Concrete Defect

The work method used will be adjusted based on the type of damage or failure in the concrete. It is because different types of damage require different handling.

Type of Concrete Defect are grouped as follows:

a) Unperfect Pile Head Treatment Pouring concrete process (Segregation on Surface area)
b) Aggregate Segregation
c) Honeycomb
d) Wall leakage (Pond, Pit, Trench, or Retaining wall)
e) Wall Structural Crack
f) Slab/ Floor Structural Crack
g) Unperfect or Defect Surface (Resurfacing)

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Application of concrete repair,

a. Area to receive repair material shall be soaked well,
b. Repairing material shall be prepared comply with manufacturer's specification, such mixing, application etc.
c. Area be received repair material shall be prepared following the material requirements,
d. Curing on repairing area shall be applied without delay,

Due to the area of defect fall into critical zone of structure, general method of repair is not acceptable. It shall be refer to the engineer's decision.

Preparation of concrete repair,

a) remove loose material completely,
b) broken area shall be cleaned off completely,
c) If re-bar surface exposed, bar surface shall be cleaned off,
d) if re-bar exposed with in break area, behind of re-bar to expose for getting enough concrete grip,

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In this case there are some choice for repair method as follow:

a) Replace defect concrete with new material
b) Replace defect concrete with grouting material
c) Epoxy Chemical injection
d) Resurfacing

Working Method

a. Unperfect Pile Head Treatment Pouring concrete process (Segregation on Surface area)

- Remove surface and clean all area that segregation by jack hammer until find good concrete layer
- Concrete stick to re-bars shall also be cleaned off completely.
- Cleaning all dust and unwanted material by compressor or Jet Washer
- Pouring bonding agent to all surface old concrete
- If thickness of chipping more than 30 cm the PHT should be re-pouring concrete with equal class until full before rebar installation or foundation pouring concrete.

- If thickness of chipping 30 cm or under it can pouring concrete together with foundation pouring concrete work. (before pouring concrete make sure bonding agent has been applied)

  - **Tools & Equipment**
    - Electric Jack Hammer
    - Jet Washer or Compressor
    - Bucket
    - Wire brush
  - **Material**
    - Bonding Agent
    - Fresh Concrete

b. Aggregate Segregation

- Before commence any repairing, inspection on prepared surface condition shall be done by QC with NFI.
- Remove loose concrete that segregation by jack hammer. Prevent the application of large forces such as electrical chippers to avoid sound concrete damage around the segregation area.
- Clean any dirt or loose material from the area.

- Wet the cleaned area before applying the repair material. Applied bonding agent
- Create Patch hole to pouring access and make sure bonding new concrete with old concrete are perfect
- If the cleaned area small it should be use non-shrink grout and apply form, but if that area large it should be use equal concrete.

➢ **Tools & Equipment**

– Electric Jack Hammer

– Jet Washer or Compressor

– Bucket

– Wire brush

– Electric Boring Machine

➢ **Material**

– Bonding Agent

– Fresh Concrete

– Non-Shrinkage Cement Grouting

c. Honeycomb

- Before commence any repairing, inspection on prepared surface condition shall be done by QC with NFI.
- Remove loose concrete or loose aggregate by hammer or wire brush. Prevent the application of large forces such as electrical chippers to avoid sound concrete damage around the honeycomb area.
- Clean any dirt or loose material from the area.
- Wet the cleaned area before applying the repair material. Applied bonding agent
- For underground structure, Retaining Wall, Pit or Pond Fill small voids and cracks using a mechanical injection pressure pump with a suitable material such as non-shrinkage epoxy grout. For upper ground structure fill void with concrete with same class and concrete expose finishing material depending on the size of void to fill, non-shrink grout shall be apply to shallow area where aggregate cannot go into fulfill the void.
- If the honeycomb covers a large area, you may need to create a patch hole to ensure proper bonding.
- Place formworks if necessary, and pour the grout or concrete with same class.

- If formwork is not used, apply suitable repair material such as High build polymer modified repair mortar or concrete with same class or higher
- The filling process should be in a 15 mm thickness layer if the depth of honeycombing is greater than 5 cm. It is recommended to wait for a while (30min) before applying the next layer.
- Repair material strength should match the existing concrete of the structural element.
- Provide texture and color required to match the surrounding concrete and maintain aesthetics.
- If present, remove formworks after 12 hours of repair based on the type of material used and ambient conditions. Cure repair material to gain adequate strength.

➢ **Tools & Equipment**

- Electric Jack Hammer
- Jet Washer
- Bucket
- Wire brush
- Electric Boring Machine
- Injection Machine
- Compressor

➢ **Material**

- Bonding Agent
- Fresh Concrete
- Non-Shrinkage Cement Grouting / High Build Polymer modified Repair Mortar (Wich one that Applicable)

  Example ; SIKA Monotop-615 HB Id or Equal

- Epoxy Chemical Injection

d. Wall leakage (Pond, Pit, Trench, or Retaining wall)

- check all area that impacted of the leakage
- chipping concrete surface that leak
- Install chemical injection nipple to the leak path
- Covered the leak path use cement
- Let 24 hour until the cement dry and hard, aplly epoxy chemical injection
- Remove injection hose, and finishing use cement expose material
  - Wire brush
  - Electric Boring Machine
  - Injection Machine
  - Compressor

➢ **Material**

- Cement
- Epoxy Chemical Injection

e. Wall Structural Crack

- Chipping crack around 2 – 3 cm space area until translucent to out side of the wall
- Cleaning Dust and unwanted material
- Install formwork both side
- Applied bounding agent to old concrete surface
- Pouring use non-shrink grout material
- Let It 24 hour until the grouting has been hard. Remove formwork from the structure
- Grinding the joint of the repaired concrete, finishing with concrete expose material
- If crack with is very big, it is not acceptable to just fill gap by grout. It is required to be determined by the engineer.
- For this special case need CONTRACTOR Decision

➢ **Tools & Equipment**

– Electric Jack Hammer

– Jet Washer

– Bucket

– Wire brush

- Electric Boring Machine
- Injection Machine
- Compressor

➢ **Material**

- Bonding Agent
- Fresh Concrete
- Non-Shrinkage Cement Grouting
- Epoxy Chemical Injection

f. Slab/ Floor Structural Crack

- If it happened hair crack will use this method
- check all area that impacted of the leakage
- chipping concrete surface that leak
- Install chemical injection nipple to the leak path
- Covered the leak path use cement
- Let 24 hour until the cement dry and hard, apply epoxy chemical injection
- Remove injection hose, and finishing use cement expose material
- If it happened structural crack and at grade slab will use this method
- Chipping crack around 2 – 3 cm space area make sure grouting material can fulfill this gap

- Cleaning Dust and unwanted material
- Applied bounding agent to old concrete surface
- Pouring As an alternate cementious material, such as high build polymer modified repair mortar (of the same class as the existing concrete) could be used vertical planes such as walls, column sides, beam sides of foundations sides.
- Let It 24 hour until the grouting has been hard.
- Grinding the joint of the repaired concrete

➢ **Tools & Equipment**

- Electric Jack Hammer
- Jet Washer
- Bucket
- Wire brush
- Electric Boring Machine
- Injection Machine
- Compressor

➢ **Material**

- Bonding Agent
- Fresh Concrete
- Non-Shrinkage Cement Grouting
- Epoxy Chemical Injection
- High build Polymer modified repair mortar ; *SIKA Monotop-615 HB ID or Equal*

g. Unperfect or Defect Surface (Resurfacing)

1. Water cement lost and peeling on surface concrete

- Chipping the concrete surface until find good concrete layer minimum 2x size of coarse aggregate (5 cm)
- Cleaning surface from dust and unwanted material by air compressor
- Install shear connector above old concrete with new concrete 2 point every 1m2 use deformed bar D10
- Install shrinkage reinforcement (it can use rebar mess with a diameter adjusted to the thickness of the new concrete or CONTRACTOR approval)
- Apply bonding agent before pouring new concrete
- Pouring concrete and follow top of concrete design elevation, finishing surface follow state on drawing
- Apply curing compound and Curing Around 7 days use Plastic or another material with the same function.

➢ **Tools & Equipment**

– Electric Jack Hammer

– Jet Washer

– Bucket

– Wire brush

- Electric Boring Machine
- Injection Machine
- Compressor

➢ **Material**

- Bonding Agent
- Fresh Concrete
- Non-Shrinkage Cement Grouting
- Epoxy Chemical Injection
- Curing Compound

2. Form Offset

- Grinding bad concrete surface use cup wheel grinder machine
- Make sure grinding finish until flat in between
- Apply cement expose material finishing for porous surface

➢ **Tools & Equipment**

- Electric Jack Hammer
- Jet Washer
- Grinding Machine

- Electric Boring Machine
- Compressor

➢ **Material**

- Bonding Agent
- Cement expose Material

3. Surface Air Voids, Bug Hole

- Soaked Surface of Concrete
- Mix Cement with Bonding Agent and Water
- Apply cement expose material finishing to bug hole surface

➢ **Tools & Equipment**

- Mixer
- Roskam

➢ **Material**

1. Bonding Agent
2. Cement expose Material
3. Water

4. Form Tie Hole

- For repair concrete imptint from the plastic cone, remove plastic cone from the concrete structure
- Soaked surface well
- Finishing use High build polymer modified repair mortar, ensure finishing good and uniform color
- Let it dry around 24 hour, make sure surface flat after the material has been hard

➢ **Tools & Equipment**

- Electric Jack Hammer
- Jet Washer
- Grinding Machine
- Electric Boring Machine
- Compressor

➢ **Material**

1. Bonding Agent

2. High build Polymer modified repair mortar

; *SIKA Monotop-615 HB ID or Equal*

3. Water

5. Form Streaks

- Remove Formwork
- Grinding Concrete surface well until the surface flat

➢ **Tools & Equipment**

– Grinding Machine

– Exhaust Fan

6. Sand Streaking

- Before commence any repairing, inspection on prepared surface condition shall be done by QC with NFI.
- Remove loose concrete or loose aggregate by hammer or wire brush. Prevent the application of large forces such as electrical chippers to avoid sound concrete damage around the honeycomb area.
- Clean any dirt or loose material from the area.
- Wet the cleaned area before applying the repair material. Applied bonding agent
- For underground structure, Retaining Wall, Pit or Pond Fill small voids and cracks using a mechanical injection pressure pump with a suitable material such as non-shrinkage epoxy grout. For upper ground structure fill void

with concrete with same class and concrete expose finishing material depending on the size of void to fill, non-shrink grout shall be apply to shallow area where aggregate cannot go into fulfill the void.

- If the honeycomb covers a large area, you may need to create a patch hole to ensure proper bonding.
- Place formworks if necessary, and pour the grout or concrete with same class.
- If formwork is not used, apply suitable repair material such as high-strength grout or concrete with same class.
- The filling process should be in a 15 mm thickness layer if the depth of honeycombing is greater than 5 cm. It is recommended to wait for a while (30min) before applying the next layer.

- Repair material strength should match the existing concrete of the structural element, as an alternate cementious material, such as High build Polymer modified repair mortar (of the same class as the existing concrete construction) could be used on vertical planes such as walls, column sides, beam sides, or foundations sides.

- Provide texture and color required to match the surrounding concrete and maintain aesthetics.
- If present, remove formworks after 12 hours of repair based on the type of material used and ambient conditions. Cure repair material to gain adequate strength.

➢ **Tools & Equipment**

- Electric Jack Hammer
- Jet Washer
- Bucket
- Wire brush

- Electric Boring Machine
- Injection Machine
- Compressor

➢ **Material**

- Bonding Agent
- Fresh Concrete
- High Build Polymer modified Repair Mortar (Wich one that Applicable) *Example ; SIKA Monotop-615 HB Id or Equal*

6 QUALITY CONTROL

Documentation

Quality control should provide checklist on all the area with defects to be recorded with corresponding photos and list. All recorded area should be documented before and after repair. Document that has been open punch item should be Jointly inspected and Aproved With CONTRACTOR. Document that has been closed shall be Submmited to CONTRACTOR as an Evidence That The Structure has been Approved.

Working Process Control

a. Make sure direct worker will be working following method statement
b. Make Sure working Process is appropriate with the method statement & shall be fully refer to the manufacturer's procedures. and also curing method shall be followed.
c. Make sure Material That used accordance with the Material Aproved

Product Control Result :

a. Make sure Class of Concrete Accordance with the Specification

b. Make sure Finishing Concrete is Good that can be seen with Uniform color, flat, appropriate dimensions.

7 SAFETY PROCEDURE

Purpose

Execution of Concrete Repair Works in a safely manner work which working safely.

Scope

This plan covers safety of concrete repair work under the responsibility of the sub-contractor.

Reference

Client specification and relevant document.

Procedure

a. Workers Safety

Every worker must fully use standard safety equipment: helmet, safety shoes, safety glasses, safety boot, face mask, and vest. For the special work need other safety equipment: hand gloves, respiratory mask, and etc, prior to the commencement of the work.

Safety harness must be worn when working above 1.2 meters and must be properly anchored. Proper working platform for work at height shall be provided for safe work.

b. Equipment

All machinery and equipment shall be checked daily by the operator prior to the commencement and any faulty parts shall be reported to the supervisor for appropriate action.

c. Area of the concrete repair work

- Prepare the plastic sheets to protect the concrete from rainy day.
- Area of the concrete repair work has to be cleaned and free from unwanted /waste material

- Ascertain whether the ground condition, in particular the ground surface which the crane is to be operated, is safe for any intended operation.
- Access way to Concrete area shall be prepared properly (good condition & well maintained).

d. Use of Tools
- All tools used on the site must be of sound construction and in good working condition.
- All damaged or worn tools shall be promptly repaired or disposed off.
- Most tools should be provided with grounding connections and be well insulated. All power tools shall be checked regularly for defects and insulation.
- Hand made tools are not allowed on site.

e. Electrical and Mechanical Installation

Qualified electricians and mechanical Engineer shall carry out all electrical and mechanical installation. Electrical equipment shall be of good construction, sound material, free from defects and maintained according to manufacturers instruction.

f. Lighting

Kind of works area on the night has to be clear and good lighting system. Lighting on access way is also required.

g. Condition of Emergency

If dangerous condition occurred at the working area be caused by collapse or failure of equipment, the man or the workers have to immediately leave the work place and go to the safe area Muster Point.

The safety officer responsible to ensure that Emergency Responsible Plan is communicated to all parties.